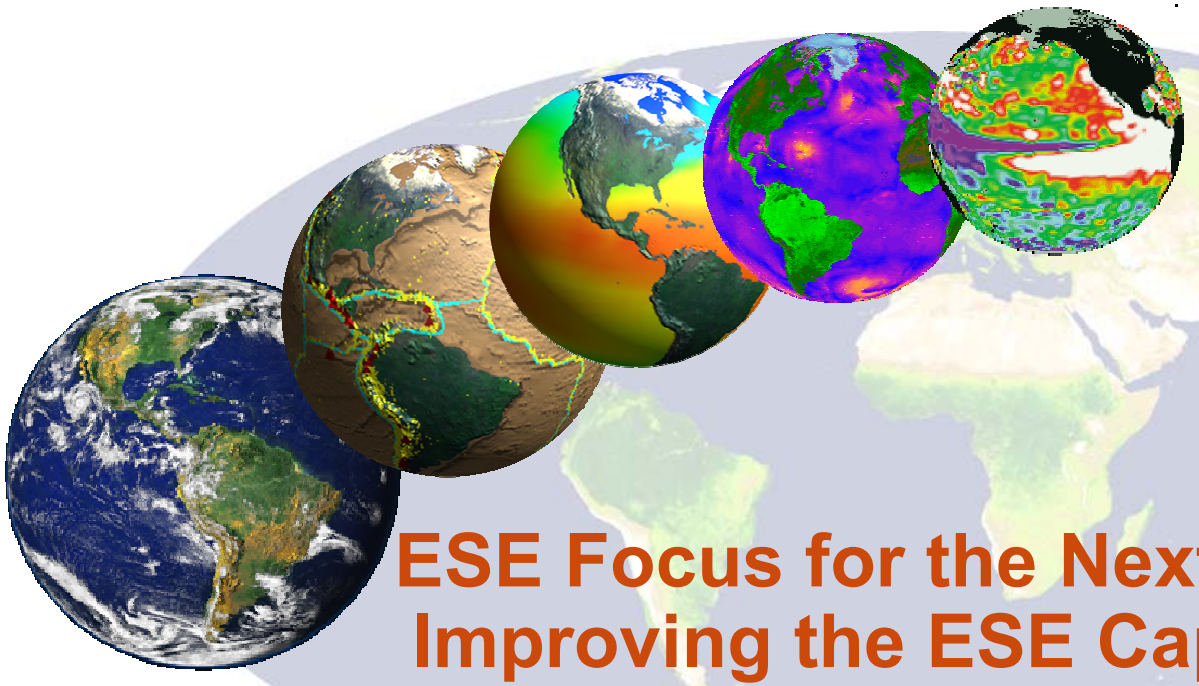
NASA's Earth Science Enterprise



ESE Focus for the Next Decade: Improving the ESE Capability to Deliver Science and Applications Results to the Nation

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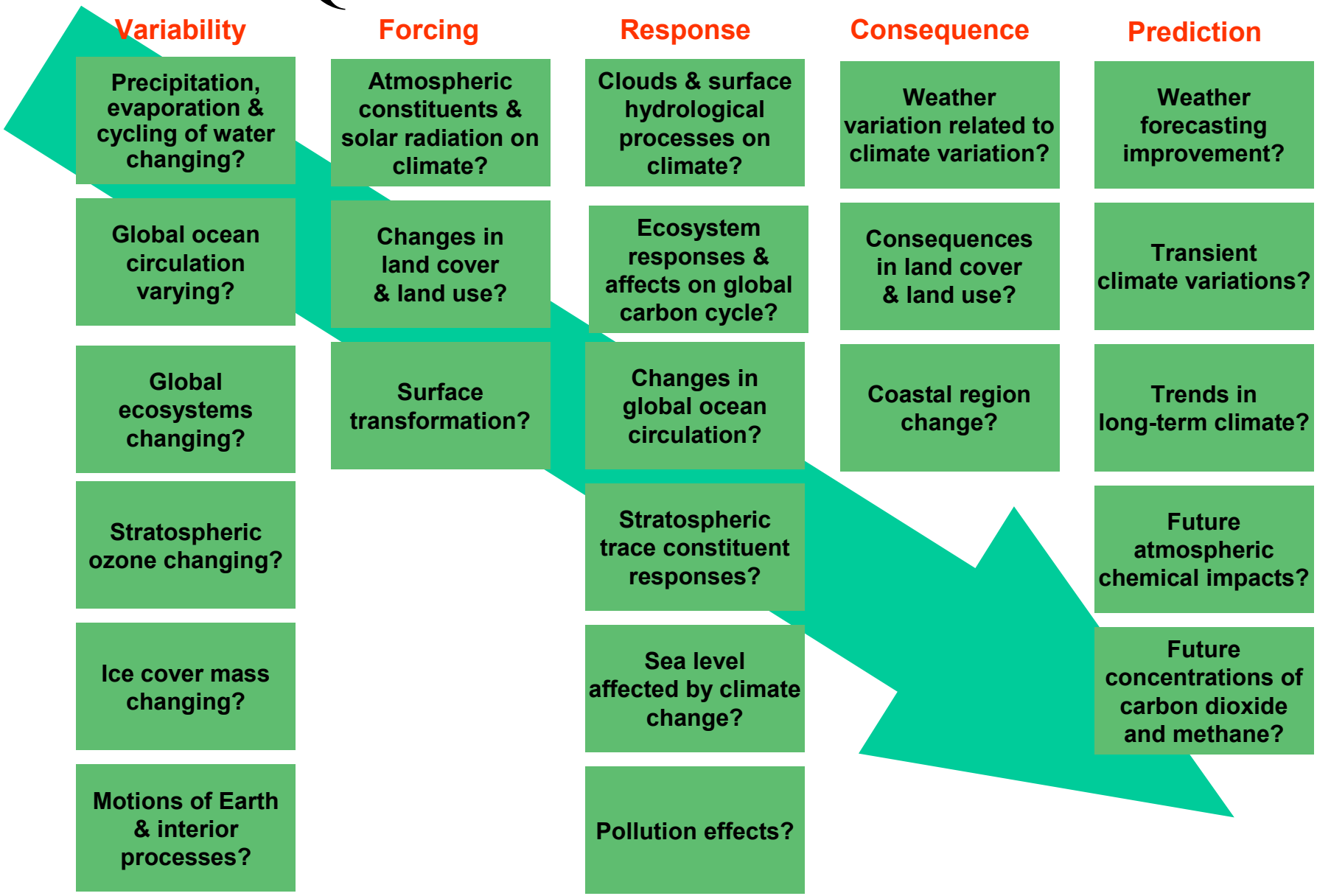
Office of Earth Science
NASA HQ

March 18, 2003


The NASA Vision
To improve life here,
To extend life to there,
To find life beyond.
The NASA Mission
To understand and protect our home planet,
To explore the universe and search for life,
To inspire the next generation of explorers
... as only NASA can.

Science Questions from the Research Plan



Earth Science National Applications

Carbon Management

Public Health

Energy Forecasting

Aviation Safety

Water Management

Homeland Security

Coastal Management

Disaster Preparedness

Agricultural Competitiveness

Invasive Species

Community Growth

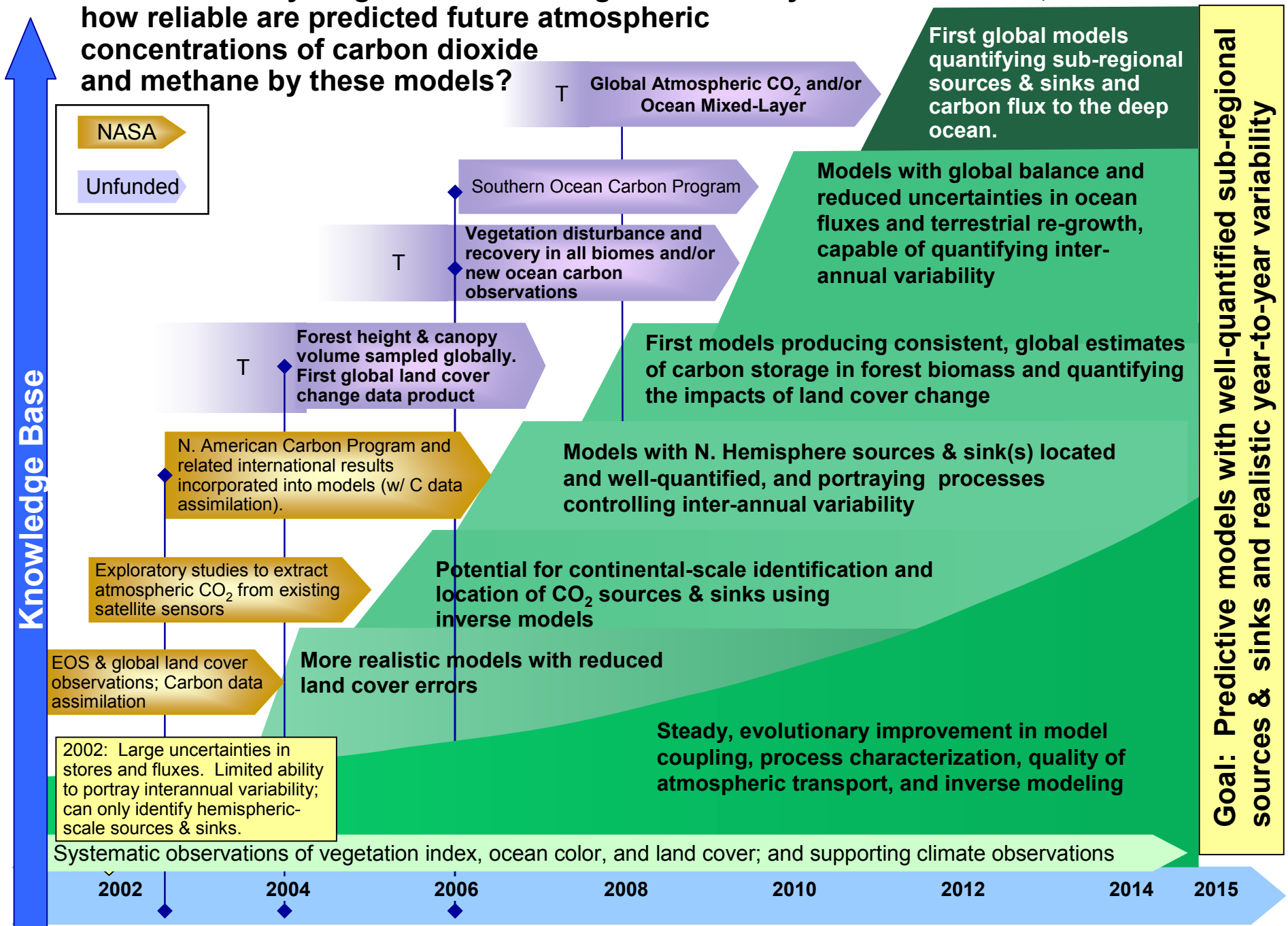
Air Quality

Implementing Science for Society

- **Engaging society in the Earth science enterprise is facilitated by identifying a concise set of important objectives within a framework of critical focus areas.**
  - **Current focus areas include:**

    - Atmospheric Composition
    - Atmospheric Dynamics and Weather
    - Global Carbon Cycle and Ecosystems
    - Global Water and Energy Cycle
    - Oceans, Ice and Climate
    - Solid Earth Science

How well can cycling of carbon through the Earth system be modeled, and how reliable are predicted future atmospheric concentrations of carbon dioxide and methane by these models?



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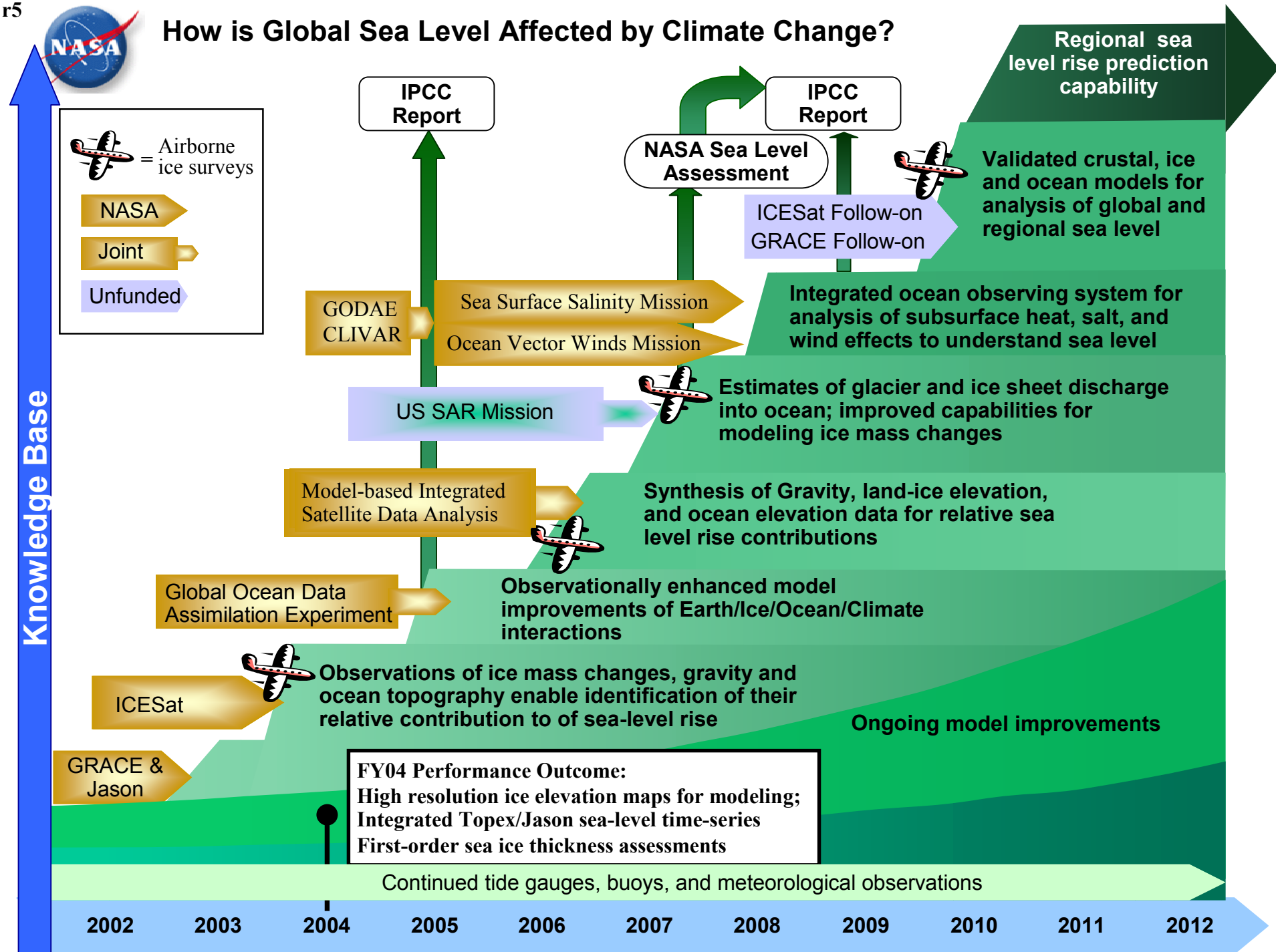
How is Global Sea Level Affected by Climate Change?



Air Quality Management:
Clean Air Standards and Air Quality Forecasts

DRAFT

EPA CMAQ & Forecasts by 2012:
- Robust emissions control planning
- Routine warnings of pollution events
- 3-day air quality forecasts

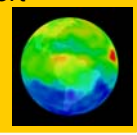
Socioeconomic Impact

Prevent:
- 15,000 premature deaths/year
- $5-10 B reduced crop yields

Primary Partners:

EPA NOAA

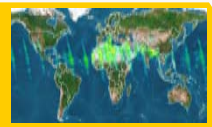
- Day/night chemistry/transport
- Trace gas measurements
- Boundary layer resolution



Outcomes: Improved pollution forecasts. Improved national emissions control planning/mitigation.

Impacts: Reduce major illnesses and deaths from air pollution episodes.

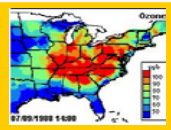
AURA - TES
- Global/regional/local distribution of ozone
- Tropospheric mixing & B.L. interaction



Outcomes: Source & destination of long-range dust & pollutants. Route airplanes. Issue health alerts and NAAQS waivers.

Impacts: Reduce wear on airplanes and engines. Improve crop estimates for international markets.

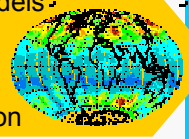
AURA - OMI
- Ozone profiles/transport
- Build on TOMS & GOME
- Aerosol & trace gas characteristics



Outcomes: Assess development policies to achieve or maintain compliance. Improve forecasts of PM and pollution episodes Warnings to hospitals & farmers.

Impacts: Reduce lung related diseases (asthma, bronchitis, pneumonia). Improve visibility. Improve crop health & yields.

- Coupled chemistry-aerosol models
- Optical depth data
- Continental inflow/outflow
- Robust satellite data assimilation



Outcomes: Quantify contributions of physical & chemical processes to pollutant concentrations. Improve ozone forecasting and regional transport.

Impacts: Reduce impaired lung function and use of medications. Reduce hospital admissions and lost work/school days.

- Validations
- Ozone residuals
- Better boundary conditions

Outcomes: Assess effects of emission control options. Evaluate development options and emission strategies to set policies and construct SIPs.

Impacts: Improve economic development opportunities within States and Regions.

CMAQ / Forecasts (c. 2002): EPA
State/regional planning.
Same-day air quality predictions.

Current trajectory:
Steady improvement in chemistry-transport models and pollution episode warnings.


TOMS


GTE


Aqua


AERONET


Aura


CloudSat


CALIPSO

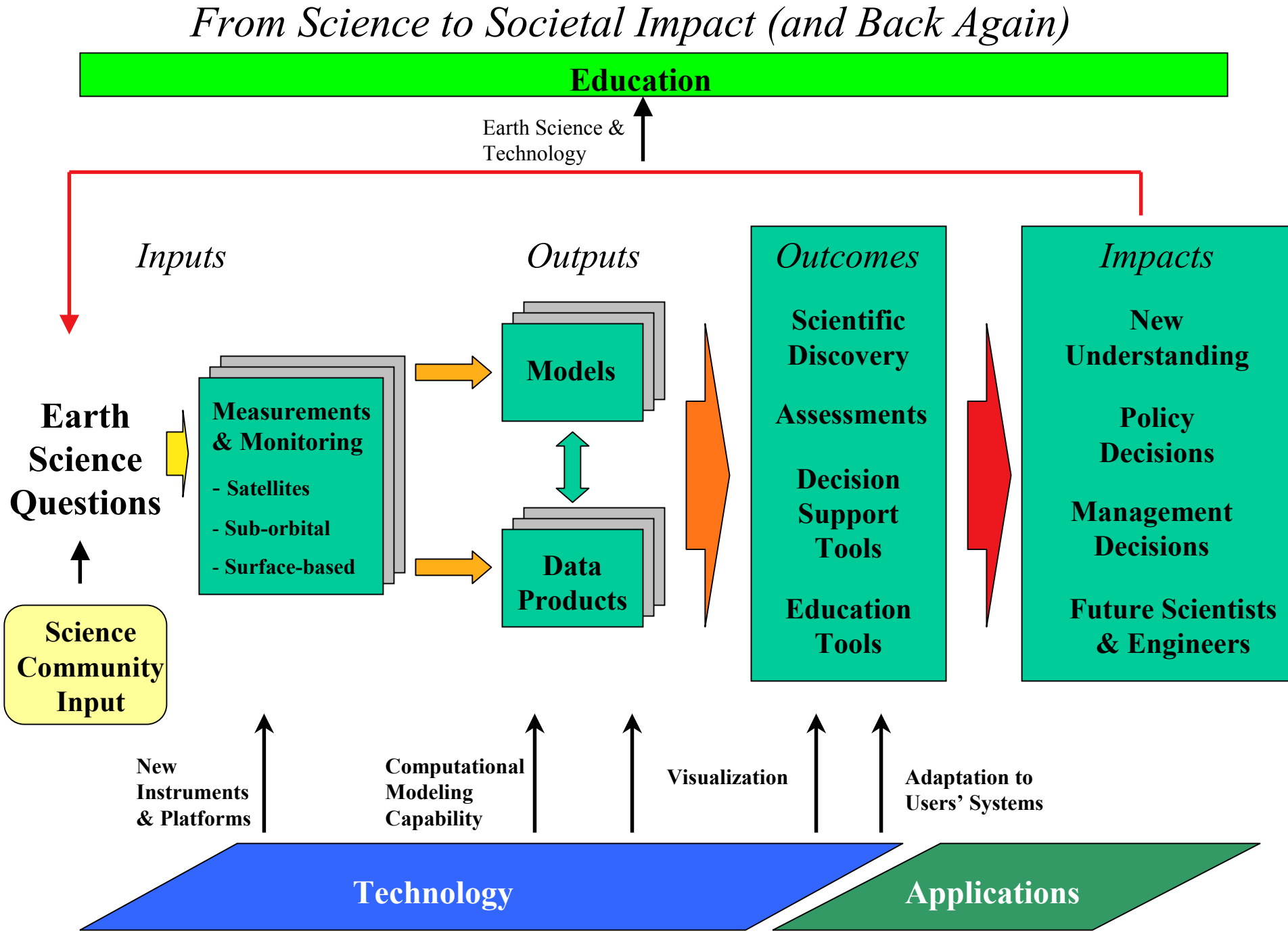

* Total Column


*NPOESS

* Pre-formulation

2000 2002 2004 2006 2008 2010 2012

Improved capabilities to air quality management tools to assess, plan and implement emissions control strategies & improve air quality forecasts.


From Science to Societal Impact (and Back Again)
Education
Earth Science & Technology
Inputs
Outputs
Outcomes
Impacts
Earth Science Questions
Measurements & Monitoring
- Satellites
- Sub-orbital
- Surface-based
Models
Data Products
Scientific Discovery
Assessments
Decision Support Tools
Education Tools
New Understanding
Policy Decisions
Management Decisions
Future Scientists & Engineers
Science Community Input
New Instruments & Platforms
Computational Modeling Capability
Visualization
Adaptation to Users' Systems
Technology
Applications

ESE Needs for the Next Decade

- Science For Society
  - Providing decision makers with dependable, objective Earth Science knowledge to improve quality and sustainability of life

- ESE Roadmaps are improving our focus on science and applications products/results
  - Shifting our focus from missions and mission-defined data sets to answering key scientific questions
  - Building and utilizing consistent long-time series climate data records for key parameters identified in the roadmaps
  - Delivering the objective information, knowledge, and services needed by policy makers and decision makers in a timely and accurate manner